

What is Claimed:

- 1 1. A method for code-tracking in CDMA communication
2 systems comprising
3 a) receiving of an electromagnetic signal (10) being a
4 superposition of a plurality of signal components
5 of
6 different signal paths (i),
7 b) digitising (14) the received signal (10, 13),
8 c) distributing the digitised signal (15) to receiver
9 fingers (1, 2, ..., N) each of which is
10 assigned to one of the signal paths,
11 d) distributing the digitised signal (110, 111) to a
12 detection stream and a synchronising stream,
13 e) decorrelating (121, 122) the digitised signal by a
14 code sequence (112) in the synchronisation stream
15 and
16 f) reducing the interference of at least one other
17 ($j \neq i$) than the signal component of the assigned
18 signal path (i) with the signal component of the
19 assigned signal path (i) in at least one of the
20 receiver fingers.
- 1 2. A method according to claim 1, wherein
2 step f) comprises a subtraction (130) of an
3 interference signal from the decorrelated digitised
4 signal (116).
- 1 3. A method according to claim 1 or 2, wherein
2 the subtraction takes place on symbol rate ($1/T$).
- 1 4. A method according to one of the preceding claims,
2 wherein interference of other signal components ($j \neq$
3 i) than the assigned signal component (i) is reduced
4 in all receiver fingers (1, 2, ..., N).
- 1 5. A method according to one of the preceding claims,
2 wherein step e) comprises decorrelating (121, 122)

- 3 the digitised signal by multiplying the digitised
4 signal with a complex-conjugate pseudo-noise code
5 sequence (112).
- 1 6. A method according to one of the preceding claims,
2 wherein an early-late timing error detection (102) is
3 provided in the synchronisation stream.
- 1 7. A method according to one of the preceding claims,
2 wherein after step f) the real part (118, \tilde{x}) of the
3 interference reduced complex signal (\tilde{y}) is determined
4 (126).
- 1 8. A method according to one of claims 1 to 6, wherein
2 before step f) the real part (x) of the complex
3 signal (116, y) is determined (126).
- 1 9. A method according to one of the preceding claims,
2 wherein after step f) the interference reduced signal
3 (118, \tilde{x}) is filtered (103) in a step g).
- 1 10. A method according to claim 9, wherein
2 steps e), f) and g) provide a code-tracking (101) of
3 the digitised signal (111).
- 1 11. A method according to claim 10, wherein
2 the code-tracking (101) provides an estimated timing
3 delay ($\hat{\tau}^{(i)}$) of the signal component of the assigned
4 signal path (i).
- 1 12. A method according to one of the preceding claims,
2 wherein prior to step f) the digitised signal (111)
3 is distributed to a first and second correlator (121,
4 122).
- 1 13. A method according to claim 12, wherein
2 the digitised signal (111) is time-shifted prior to
3 feeding it to the second correlator (122) providing

4 late and early estimates (113, 114) as output of the
5 first and second correlator (121, 122), respectively.

1 14. A method according to claim 13, wherein
2 the early and late estimates (114, 113) are
3 subtracted (124) yielding an intermediate signal
4 (117).

1 15. A method according to claim 14, wherein the
2 intermediate signal (117) is multiplied (125) with
3 reconstructed transmitted symbols (115).

1 16. A rake receiver (17) for processing a received
2 electromagnetic signal (10) being a superposition of
3 signal components of different signal paths,
4 comprising

5 a plurality of receiver fingers (1, 2, ..., N),
6 wherein at least one of the receiver fingers (1,
7 2, ..., N) is adapted to receive a signal component
8 assigned to one of the signal paths (i) with
9 $i \in \{1, \dots, N\}$

10 a timing error detector (102) for estimating an
11 error of a delay ($\hat{\tau}_k^{(i)}$) of the signal component of the
12 assigned signal path (i) and

13 an interference reduction device (131) adapted to
14 reduce the interference of at least one other signal
15 component (j) with $j \neq i$ and $j \in \{1, \dots, N\}$ with the
16 said signal component of the assigned signal path
17 (i).

1 17. A rake receiver (17) according to claim 16, wherein
2 the interference reduction device (131) comprises an
3 interference computation module (132) being adapted
4 to receive complex path weights ($c_k^{(j)}$, 134) and path
5 delays ($\hat{\tau}_k^{(i)}$, $\hat{\tau}_k^{(j)}$) to compute an interference signal of

6 at least one other signal component (j) with the said
7 signal component of the assigned signal path (i).

1 18. A rake receiver (17) according to claim 16 or 17,
2 wherein
3 the interference reduction device (131) is adapted to
4 subtract (130) the interference signal of at least
5 one other signal component (j) from the said signal
6 component of the assigned signal path (i).

1 19. A rake receiver (17) according to one of the
2 preceding device claims, comprising an A/D-converter
3 (14) upstream of the receiver fingers (1, 2, ..., N),
4 for digitising the received signal (10, 13).

1 20. A rake receiver (17) according to one of the
2 preceding device claims, wherein the timing error
3 detector (102) comprises an early-late gate timing
4 error detector.

1 21. A rake receiver (17) according to one of the
2 preceding device claims, wherein each receiver finger
3 (1, 2, ..., N) comprises a loop filter (103).

1 22. A rake receiver (17) according to claim 21, wherein
2 each receiver finger (1, 2, ..., N) comprises a code-
3 tracking loop (101) comprising the timing error
4 detector (102) and the loop filter (103).

1 23. A rake receiver (17) according to claim 22, wherein
2 the code-tracking loop (101) is adapted to estimate a
3 timing delay ($\hat{\tau}^{(i)}$) of the signal component of the
4 assigned signal path (i).

1 24. A rake receiver (17) according to one of the
2 preceding device claims, wherein the timing error

3 detector (102) is adapted to provide pseudo-noise
4 (112) decorrelation
5 (121, 122).

1 25. A rake receiver (17) according to one of the
2 preceding device claims, which is adapted for direct-
3 sequence code-division multiple access communication.